New Superplastic Ceramics

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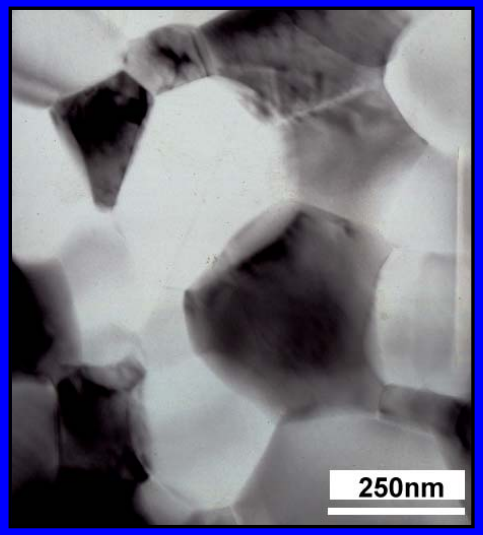
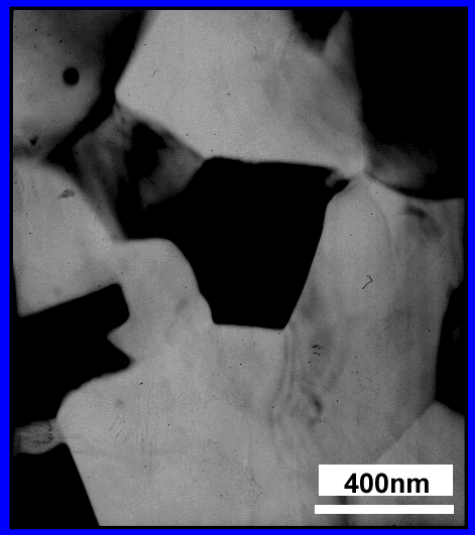
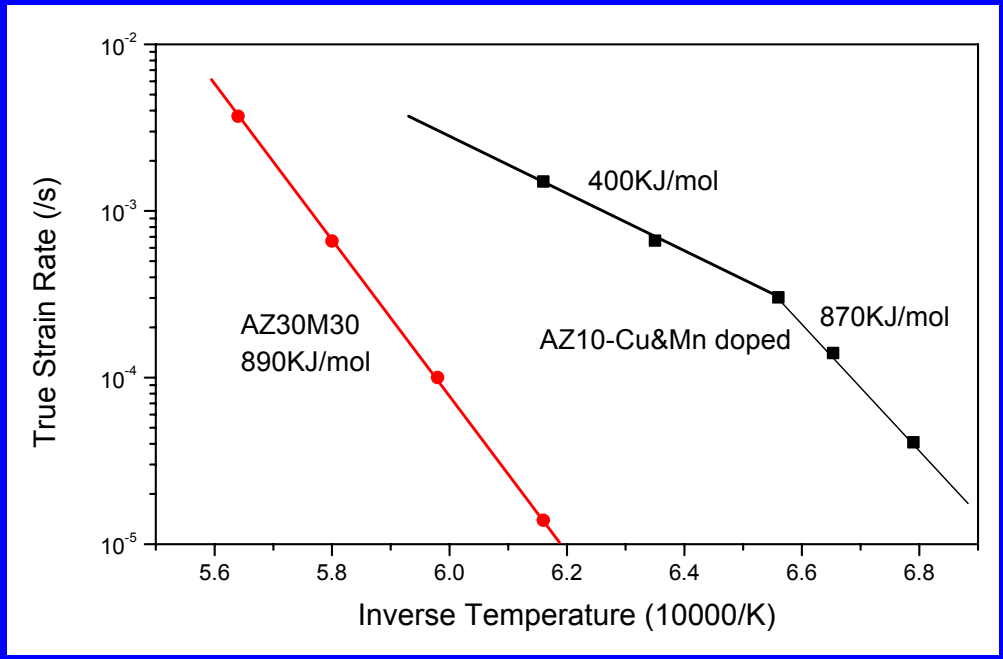
This NSF funded project is designed to create new superplastic ceramic materials that can be easily formed into complex shapes at high temperatures, avoiding expensive machining, while maintaining desirable the ceramic properties of high toughness, high stiffness, and high hardness at room temperature. Recent developments include two new alumina-based ceramic composites; alumina with 30 vol.% zirconia and 30 vol.% mullite (AZ30M30), and alumina with 10 vol% zirconia and 0.25 mol% CuO and 0.25 mol% Mn3O4 (AZ10-Cu&Mn doped). These materials have a fine grain microstructure, superplastic behavior at temperatures as low as 1250˚C, and promising mechanical properties.



AZ30M30



AZ10-Cu & Mn Doped



Broader Impacts 2004

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- Research published in Scripta Materialia, accepted in the Journal of the American Ceramic Society, and under review at the Journal of Materials Research in 2004.
- Graduate student participation of Peter Dillon and Tiandan Chen in conference talks at the American Ceramics Society Spring 2004 Annual Meeting and in posters at the 2004 Gordon Research Conference on Solid State Studies in Ceramics.
- Michael Martin completed Ph.D. dissertation, now employed as Director of Fuel Cell Technology, EMTEC, Dayton, Ohio.
- Ongoing collaborations with Neal Evans and Jim Bentley at Oak Ridge National Laboratory with graduate student research visits for analytical TEM and joint publications.
- Visiting professor Suleyman Tekeli of Gazi University, Turkey collaborating at UC Irvine summer 2004 on novel zirconia-based superplastic ceramics.
- Undergraduate student researcher Michelle Lutes won 2nd place in the American Ceramic Society 2004 Ceramographic competition, Undergraduate Division, for research correlating grain growth and impedance spectroscopy of superplastic ceramics.